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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Richard M. KELSO et al.	Confirmation No.: 6189
Appln. No.	:	09/857,204	Examiner: D. L. Sorkin
Filed	:	September 18, 2001	Group Art Unit: 1723
For	:	FLUID MIXING DEVICE	

DECLARATION UNDER 37 C.F.R./1.132

Commissioner for Patents
U.S. Patent and Trademark Office
Customer Service Window, Mail Stop Amendment
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Sir :

I, Richard Malcolm Kelso, of 175 Stephen Terrace, Walkerville, South Australia 5081, Australia, declare as follows:

1. That I am a named inventor of the invention disclosed in U.S. Patent Application No. 09/857,204, filed as PCT/AU99/01164 on December 24, 1999 (hereinafter referred to as the patent application), and claiming priority to Australian Patent Application PP7936/98, filed on December 24, 1998.

2. That I hold the degrees of Batchelor Engineering and Doctor of Philosophy, and am Associate Professor in Mechanical Engineering at the University of Adelaide in Adelaide, South Australia. I have more than 25 years of experience working in the areas of fluid mechanics, aerodynamics and combustion, and have worked with Institutions including the Australian Defence Science and Technology Organisation (DSTO), the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the University of Melbourne, Princeton University and a number of private companies. I have more than fifty publications in International Journals and conference proceedings. I have written a textbook chapter and am an inventor on two patents and have also written numerous consulting reports and articles. Annexed hereto and marked RMK-1 is a more detailed listing of my publications and presentations.

3. That I have delivered conference papers and lectures internationally in transverse jet research and flow visualisation. I regularly review papers for international journals including the Journal of Fluid Mechanics, Physics of Fluids, Experimental Thermal and Fluid Science and ASME Journal of Fluids Engineering. I also have reviewed numerous Masters and PhD Thesis in these fields.

4. That I am a tenured staff member in the School of Mechanical Engineering and my past and present duties and appointments have included Associate Dean (Undergraduate), Acting Head of

Department and Convenor of numerous Faculty Committees. I teach undergraduate courses in fluid mechanics and aerospace engineering from fundamental to advanced levels.

5. That, since joining the University of Adelaide in 1995, I have individually or jointly been awarded more than $3M in competitive funding support, a large DSTO contract ($300,000) and numerous smaller consulting contracts. I have consulted with companies and organizations such as Davy McKee Pacific, Adelaide Brighton Cement, Sydney Organising Committee for the Olympic Games (SOCOG), the Royal Australian Air Force, Ocean Power Technology, Australian Submarine Corporation, DSTO, State Opera of South Australia, FCT Combustion and Indigo Technologies.

6. That I was the Chief Design Coordinator for the team that designed the fuel and combustion system for the Sydney 2000 Olympic Relay Torch. I also led, jointly with Graham (Gus) Nathan, the University of Adelaide Technical Design Team for the Sydney 2000 Olympic stadium cauldron. I was also a senior member of the team that developed the Athens 2004 Olympic Relay Torch, Olympic stadium cauldron and rings of fire. I also consulted for five weeks on the International and Greek stages of the Athens 2004 Olympic Torch Relay. I also worked jointly to develop the 2006 Doha Asian Games torches and the 25 MW cauldron for the Doha Sports City Tower which is possibly the largest ceremonial flame ever built.

7. That I have reviewed the Office Action dated February 14, 2007 in the patent application, in which claim 38 is rejected under 35 U.S.C. /112, first paragraph, on the basis that the patent application as filed does not provide a written description of the invention to which claim 38 is directed, and particularly of the features said chamber being substantially free of fluid flow obstructions extending in a direction transverse to the jet fluid flow in a region between said second fluid inlet and said first fluid inlet .

8. That the patent application as filed describes a fluid mixing device which is resistant to changes in cross flow direction and speed. As described in the patent application as filed, resistance to changes in cross flow direction and speed is particularly important in a number of applications including an embodiment of a burner that will provide a stable and continuous flame whilst being subject to winds or draughts of widely variable direction and speed.

9. That the invention described in the patent application as filed relies on the establishment of a recirculating vortex within a chamber that results from the mixture of fluids from a first fluid inlet and second fluid inlet(s) to produce a mixture of fluids that is directed through mixed fluid outlet(s). The patent application as filed, and particularly at page 4, lines 4-9, describes the mixing device produces a self stabilising flow pattern which is independent of the wind direction and speed. The independence from cross-wind speed and direction requires that only one dominant flow pattern be established independent of external flow direction and speed. The Abstract of the patent application

as filed discloses a fluid mixing device (1) which includes a chamber (3) and a bluff body (4) defining one end of the chamber (3), as well as a first fluid inlet (5) located toward an opposite end of the chamber (3) from the bluff body and arranged to direct fluid toward the bluff body (4). Moreover, the patent application as filed, and particularly at page 9, lines 27-31, explains that the purpose of the bluff body is to deflect a proportion of the jet inlet flow radially outwards from the axis of the device. The patent application as filed discloses that the bluff body defines one end of the chamber. Further, the drawings and specification of the patent application as filed do not disclose any substantial obstruction transverse to the direction of the fluid flow towards the bluff body other than the bluff body itself.

10. That, at least from the above, it is evident that the patent application as filed at least implicitly discloses therein that the fluid flow chamber is substantially free of fluid flow obstructions extending in a direction transverse to the jet fluid flow in a region between the second fluid inlet and the first fluid inlet.

11. That, further expanding upon the disclosure in the patent application as filed, it would be clear to a skilled artisan upon reading the patent application as filed that there cannot be such a substantial transverse obstruction, and that transverse obstructions would restrict the flow of fluid in the region between the second fluid inlet and first fluid inlet. In the worst case, this would completely block the flow of fluid from the second fluid inlet so that the device would not function

at all. Partial obstruction would limit the flow of second fluid into the vortex recirculation or mixing region and would prevent proper mixing. This is because the mixing device causes the second fluid to be induced through the second fluid inlet(s) due to the establishment of a low internal pressure within the chamber. The low internal pressure is generated by the high speed fluid jet from the first fluid inlet. As a result, the flow from the second fluid inlet is extremely sensitive to obstructions in the fluid flow path. Consequently, in order to achieve the required mixing within the chamber, the fluid flow path from the second fluid inlet must be substantially unobstructed. The patent application as filed, and particularly at page 5, lines 1 to 19, lists modifications which are each designed to reduce the resistance to the flow of the second fluid. The reference to these modifications in the patent application as filed further demonstrates to the skilled artisan that the chamber would necessarily be substantially free of transverse obstructions.

12. That the absence of a substantial obstruction extending transversely in the chamber would be readily appreciated by the skilled artisan, particularly in relation to the operation of the mixing device in the configuration of a burner. The patent application as filed, and particularly at page 8, lines 9 to 12, explains the formation of an internal flame adjacent to the base of the flow divider. This internal flame is a beneficial result of the recirculating vortex within the chamber, and it occurs at the base of the flow divider at the interface between the recirculating first fluid (fuel) and the induced second fluid (air). This flame is beneficial because it provides a pilot flame that is shielded from external wind. In the event that the external flame is extinguished the pilot flame

will re-light the external flame. Relighting occurs by flame propagation from the internal pilot flame through the region between the bluff body and the flow divider to the outside of the burner. The existence of a substantial obstruction extending transversely in the chamber would prevent formation of the internal flame explained in the patent application as filed.

13. That, for the internal flame to exist, the flow pattern within the chamber must not be disrupted. A significant disruption would occur if the flow path of the second fluid (air) were deflected or restricted. Should a partial obstruction, such as a transverse obstruction that restricts flow in the direction parallel to the first fluid inlet, be placed between the first fluid inlet and second fluid inlet(s), the path of the second fluid flow would be changed and the formation of large-scale recirculation would be impaired. Such an obstruction may (at best) have the effect of reducing the maximum air/fuel ratio in the chamber, making the air/fuel mixture non-combustible and preventing formation of the internal flame. Alternatively, such an obstruction may cause the large recirculating vortex to break down into a larger number of small short-lived eddies which cannot provide a stable anchoring point for an internal flame.

14. That, for the embodiment of the burner, the zero-cross-wind condition is the condition where the minimum air flow occurs into the chamber through the second fluid inlet(s), thus leading to the lowest average air/fuel ratio within the recirculating vortex. When a cross-wind occurs, the ram-air effect forces air into the second fluid inlet(s), thereby increasing the amount and speed of air flowing

into the chamber. Experience shows that the effect of this increased air flow is to increase the intensity of mixing and combustion within the chamber, the stability of the flow pattern and the robustness of the pilot flame. The inclusion of any substantial obstruction between the first fluid inlet and second fluid inlet(s) would, at the very least, reduce the amount and speed of the air flowing into the chamber, thus reducing the flame stability and preventing the burner from functioning as intended.° Figure 19 shows a number of holes (21) in the chamber wall. The holes (21) in the chamber wall are intended to allow additional air flow into the chamber under zero-cross-wind condition, providing an additional mechanism to increase the stability of the flow pattern and the robustness of the pilot flame.

15. That, in order for the internal pilot flame to re-light the external flame, there must be a path of combustible air/fuel mixture between the internal pilot flame and the external flame. This is readily achieved for the embodiment of the burner as defined in the patent application. Thus, any restriction in the air flow by obstructions introduced between the first fluid inlet and second fluid inlet(s) will adversely alter the flow pattern and mixing within the chamber and, in turn, will have a detrimental effect on the burner's capacity to re-light.° The abovementioned holes (21) in the chamber wall, which increase the air flow into the chamber, have been shown to improve the re-lighting performance of the burner. In addition, the apertures in the bluff body (see Fig 12) which are used as a means to reduce the amount of fuel that is recirculated within the burner, have also been shown to affect the re-lighting performance of the burner. The effect of an obstruction

may, to some extent, be compensated by the use of these measures. However, a flow obstruction between the first fluid inlet and second fluid inlet(s) offers no benefits, and would simply lead to degraded performance. Accordingly, the skilled artisan reading the disclosure of the patent application as filed would understand that the chamber must be substantially free of fluid flow obstructions in the region between the first fluid inlet and second fluid inlet(s) in order for the fluid mixing device to function as described in the patent application as filed.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that the statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the U.S. Code, and that such willful false statements may jeopardize the validity of the patent application or any patent issuing thereon.

Richard M. Kelso

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August 14, 2007

Date